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SALT WATER INJURY OF WOODY PLANTS RESULTING FROM THE HURRICANE OF SEPTEMBER 21, 1938

SINCE last year's Hurricane, it has been particularly interesting to note the rapidity with which certain trees and shrubs recovered from salt water injury. Many plants have shown a remarkable ability to withstand immersion in salt water for twenty-four hours and longer. Because of this, a study was made of certain sections around Woods Hole and Falmouth, in Massachusetts; Newport, Rhode Island; and places along the north shore of Massachusetts, a year after the hurricane, in an attempt to see how well injured plants were recovering. As a result of these observations, the appended lists are presented. These data were compiled on special trips to the areas indicated and have been checked by several individuals who have been doing landscape work in the regions. Mr. Wilfred Wheeler, of Hatchville, Massachusetts, has been particularly observant and helpful, and assisted materially with his important observations and has also checked the lists.

Lawns

Many lawns were flooded with salt water, and in the spring anxious property holders sent many soil samples to the Rhode Island Experiment Station for analysis. Several of these samples were analyzed but in no case was a sufficiently heavy accumulation of salts found to cause permanent injury to the soil. No great accumulation of salt in the soil took place because the ground was thoroughly saturated with water before the storm struck. It had been raining steadily during the four days preceeding the storm, and in the months following there was plenty of rain and snow, so that much of the salt remaining after the storm was leached out before spring. However, there were many cases

where either the grass foliage or the grass roots or both were killed.

Standard practice for renovating immersed lawns was to apply ground limestone at the rate of 20–50 pounds per thousand square feet and thoroughly water the areas after the limestone was applied. If the grass roots were not killed, new growth appeared in the spring. If the grass roots were killed, the soil was dug up and the affected areas were reseeded, standard applications of regularly recommended fertilizers being made at the same time. Different grasses reacted in different ways. Bent grass and Kentucky Blue grass were easily killed, while the omnipresent crabgrass eventually appeared even after being submerged 24 hours or more. Several areas around Woods Hole where salt water had stood for 24 hours, observed one year later, were a good green—from a distance. On close examination, the grasses and weeds making this green color were of some of the coarser and more objectionable sorts, but, nevertheless, the fact remains that they were not killed and made an excellent recovery.

Trees and Shrubs

Although considerable care was taken in observing the extent of salt water injury on trees and shrubs, conditions differed widely, and plants that may have suffered severe damage in one place may have been unharmed in others. This may be on account of variations in soil, drainage, and the length of time the salt water stood about the plant roots. Salt-spray injury also differed widely, perhaps chiefly because of varying degrees in exposure, wind velocities at the time of the storm, height, age and condition of the plants, and other factors.

Consequently, the information included herein should be taken only at its face value. It merely represents observations made in areas where salt water damage to woody plants was greatest. Many commonly grown plants were not observed in the flooded areas examined; consequently numerous additions to the lists can and should be made as additional data becomes available. Fortunately, with hurricanes in the east spaced 100 years apart, it is not necessary that the fear of another in the immediate future should govern present seashore planting. Since continual planting is being done, it is hoped that the following lists may prove helpful to those engaged in selecting the right kind of plant material for exposed seashore situations. It is very seldom that such a golden opportunity is offered to study the effects of wide-spread salt water damage to woody plants, and, since the opportunity has presented itself, it was thought advisable to take advantage of it and make careful notes on individual species before the damage became minimized by the soothing effects of time.

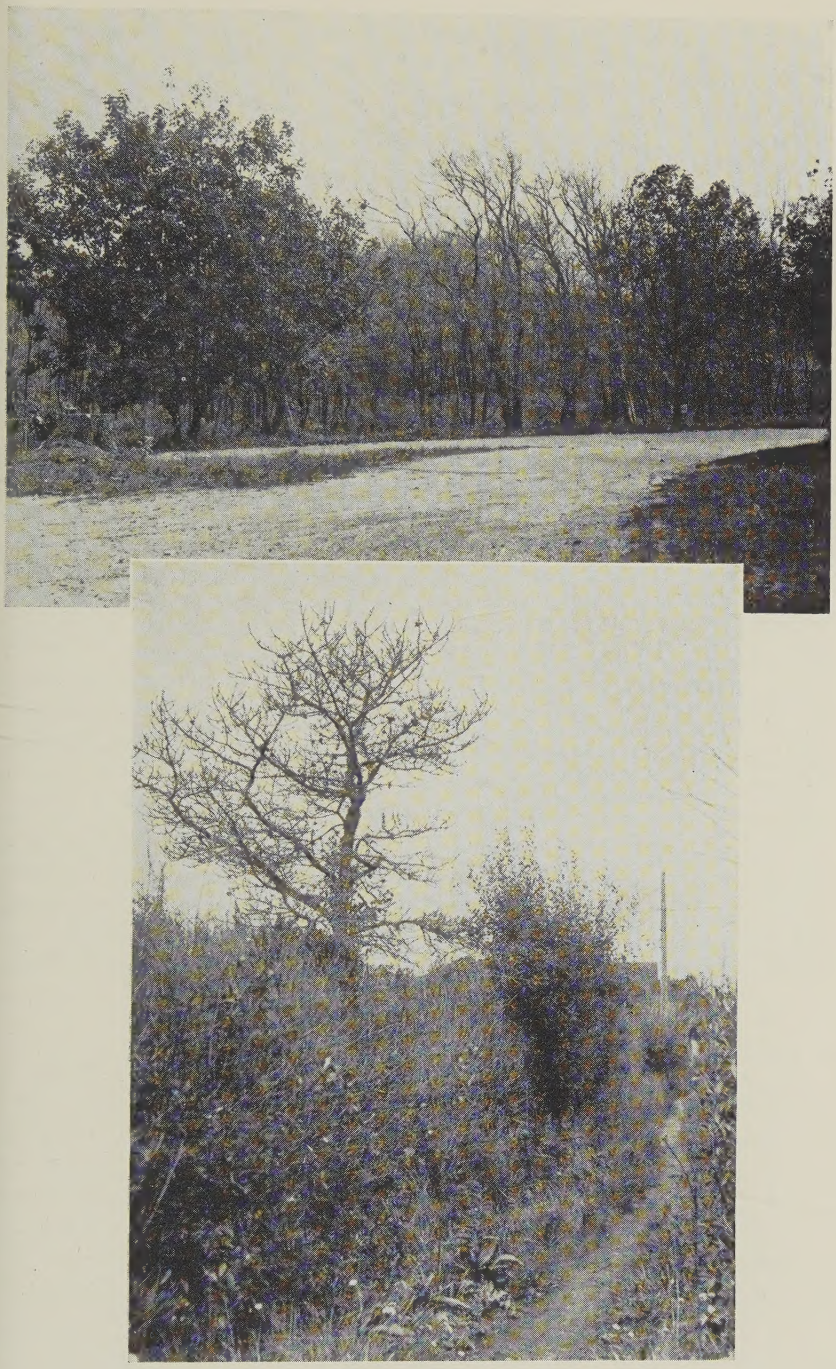

PLATE VIII

Pictures taken in Eel Pond swamp, Woods Hole, September 29, 1939.

At the top, Sycamore maple, Acer pseudoplatanus is growing unharmed though its roots were submerged with salt water for 24 hours. Nearby, red maple, elm and birch have been severely injured.

Lower picture shows red maple and Pinus rigida killed, while white willow, bayberry, azalea and various grasses are growing well.

The following plants were submerged in salt water for at least 24 hours after the hurricane and were recovering satisfactorily when observed one year later.

(In all cases the roots were submerged, and in many cases the plants themselves or portions of them. Satisfactory recovery means that, although injured, these plants were sending out vigorous suckers from the base or from the larger stems, or the tops were sending out new shoots. It should be noted here that if the inundation had come after a long drought and the soil had not been saturated with water, there might have been a considerably greater injury.)

Acer pseudoplatanus
Aesculus hippocastanum
Ailanthus altissima
Aronia arbutifolia
Calluna vulgaris
Campsis radicans
Catalpa speciosa
Clematis paniculata
Clethra alnifolia
Comptonia asplenifolia
Corylus americana
Cryptomeria japonica
Hibiscus syriacus
Ilex glabra
Juniperus chinensis pfitzeriana
Juniperus virginiana
Juniperus virginiana glauca
Ligustrum amurense
Ligustrum ovalifolium
Malus sylvestris
Myrica pensylvanica (M. carolinensis)
Nyssa sylvatica
Parthenocissus tricuspidata
Populus grandidentata
Picea canadensis
Picea pungens kosteri
Pinus sylvestris
Pinus thunbergi
Prunus martima
Prunus serotina
Prunus virginiana
Pyrus communis
Quercus alba
Rhododendron viscosum
Rhus aromatica (R.canadensis)
Rhus copallina
Rhus glabra
Rhus toxicodendron
Rhus typhina
Rhus vernix
Robinia pseudoacacia
Rosa (Ramblers)
Rosa rugosa
Rosa virginiana
Rosa wichuraiana
Salix alba
Sambucus canadensis
Smilax glauca
Spiraea prunifolia
Tamarix parviflora
Tilia cordata
Ulmus pumila
Vaccinium corymbosum
Viburnum dentatum
Vitis labrusca
Wisteria sinensis

PLATE IX

The Japanese Black Pine (P.thunbergi) was outstanding in its resistance to salt water. This one, only a few hundred feet from the shore at Woods Hole. was exposed to the worst of salt spray and was even covered with salt water, yet it came through in perfect condition.

Plants subjected to salt spray and either uninjured or not injured seriously

(The hurricane came only a few weeks before most deciduous trees dropped their leaves; consequently, salt spray injury was comparatively worse on the evergreens. The amount of salt spray varied considerably in different locations, and many of the plants in this list would be injured in one place and uninjured in another. Many other plants may have weathered salt spray injury satisfactorily but do not appear on this list because they were not observed. These facts should be kept in mind when studying the list.)

Acer platanoides
Acer pseudoplatanus
Actinidia arguta
Ailanthus altissima
Amelanchier canadensis
Arctostaphylos uva-ursi
Baccharis halimifolia
Cedrus atlantica glauca
Cephalanthus occidentalis
Chamaecyparis pisifera plumosa
Chamaecyparis pisifera squarrosa (damaged somewhat)
Clethra alnifolia
Crataegus crus-galli
Cytisus scoparius
Elaeagnus angustifolia
Elaeagnus longipes
Fagus sylvatica
Forsythia species
Hippophae rhamnoides
Hydrangea macrophylla (H. hortensis)
Ilex glabra
Ilex opaca
Juniperus communis
Juniperus communis depressa
Juniperus excelsa stricta
Juniperus horizontalis
Juniperus virginiana
Juniperus virginiana glauca
Kalmia angustifolia
Ligustrum amurense
Lonicera japonica halliana
Lonicera morrowi
Lonicera tatarica
Malus sylvestris
Myrica pensylvanica (M. carolinensis)
Parthenocissus tricuspidata
Physocarpus opulifolius
Picea abies
Picea asperata
Picea canadensis
Picea glauca
Picea orientalis
Picea pungens kosteri
Pieris japonica
Pinus mugo mughus (varied responses on different soils)
Pinus nigra
Pinus thunbergi
Populus alba
Prunus maritima
Pyrus communis
Quercus marilandica
Rhamnus cathartica
Rhus copallina
Rhus glabra
Rhus toxicodendron
Rhus typhina

Robinia pseudoacacia
Rosa (ramblers)
Rosa blanda
Rosa humilis
Rosa nitida
Rosa rugosa
Rosa virginiana
Rosa wichuraiana
Salix humilis
Sambucus canadensis
Spiraea species
Syringa vulgaris (if submerged, it was killed)
Tamarix parviflora
Taxus species and varieties (even took submergence for 2–3 days in some instances though they did not respond as well as Pfitzer's juniper).
Tilia americana
Tilia cordata
Tilia vulgaris
Thuja occidentalis varieties
Ulmus pumila
Vaccinium corymbosum
Viburnum cassinoides
Viburnum dentatum
Wisteria sinensis

Plants killed or very seriously injured by salt water

(If salt water stood on the soil long enough it would kill all the roots of most trees and shrubs, except a very few like Baccharis. The plants listed below were killed or seriously injured by salt spray, by submergence in salt water, or by both.)

Abies concolor
Abies pinsapo
Acer rubrum
Azaleas (evergreen types)
Berberis thunbergi
Betula papyrifera
Betula populifolia
Buxus sempervirens
Buxus sempervirens suffruticosa
Cephalanthus occidentalis
Chamaecyparis species and varieties
Clematis virginiana
Euonymus species and varieties
Ginkgo biloba
Hedera helix
Larix decidua
Liquidambar styraciflua
Liriodendron tulipifera
Lyonia ligustrina
Parthenocissus quinquefolia
Pinus rigida
Pinus strobus
Pseudotsuga taxifolia (P. douglasi)
Rhododendrons (evergreen types)
Rosa—(Any grafted or budded rose) Injury may have been due to sudden freeze late in the fall, more than to salt water injury.
Sassafras albidum (S. officinale) (but coming up from roots)
Tsuga canadensis
Ulmus americana
Ulmus fulva
Weigela species and varieties

NOTE

Through the support received from a number of friends of the Arnold Arboretum it has been possible to establish a Fellowship for 1939-40 which has been assigned to Miss Luetta Chen, a Chinese student taking graduate work in botany in Radcliffe College. This has been designated the "George B. Emerson Fellowship" in memory of Mr. Emerson, one of the trustees of the James Arnold estate, and the individual who actually suggested the establishment of the Arnold Arboretum. Because of his enthusiasm and interest, the trustees of the Arnold estate were inspired to transfer the initial endowment of $100,000 to Harvard University, provided the University would set aside a part of the Bussey farm as a site and foster the establishment of the Arnold Arboretum.

DONALD WYMAN